FI

PTO 03-378

Patent Application No. 3345/68

English translation

FELT-CONDITIONING EQUIPMENT

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UNITED STATES PATENT AND TRADEMARK OFFICE
WASHINGTON, D.C. NOVEMBER 2002
TRANSLATED BY THE RALPH MCELROY TRANSLATION COMPANY

PATENT APPLICATION NO. 3345/68

Int. Cl.:	D 21 f 1/32
Cl.:	~~55 d 9/01~~
Filing Date:	November 22, 1968
Transferred starting date:	
Announced:	May 24, 1969
Cancelled:	August 12, 1970

To: Patent and Registry Administration
Bulevardi 21, Helsinki 18

PATENT APPLICATION

Applicant:
Full name, place of residence, and address. (If more than one person applies for a patent jointly, state whether one of them is authorized to receive notices from the Patent Office on behalf of all.)

Inventor:
Name and address

Name of invention:
(If possible, also in Swedish)

Priority:
Date:
Country:
No.:

Additional patent application □ To be added to application no.

Application separated by division	□	Basic application no.
Split	□	Requested starting date

Appendices:

□ Copy of application book
□ Description in 3 copies
□ Claims "
_____ (day) _____ (month), 19__

The invention concerns felt-conditioning equipment.

It is known in paper production, for example with a Fourdrinier machine, that the porosity of the felts in the wet-pressing section declines continually during long continuous usage, because fibrous and other matter accumulates on the surfaces of the felt that contact the web. These contaminants stick to the felt and clog the pores of the felt as the web or paper that has just been formed is dried by being pressed between the pressing rollers of the wet-pressing section.

It is obviously good to clean the felts, not only in order to reduce replacements, but also to prevent the web from being flattened or crushed, for example by dirt in small balls, which may cause the web to stick to the upper roller. A device is also known that moves by itself slowly across the machine, first in one direction and then in the opposite direction, always contacting the surface of the felt. At present however, the effectiveness of felt conditioning and cleaning is not satisfactory, at least for some machines currently being used, in which the travel speed of the paper or other web is high, in particular as much as 900 m/min while the width of the screen is 760 cm.

The main purpose of the invention is to achieve felt cleaning and conditioning such that when done, even when the speed of the paper web and parts connected to it is according to the speeds of machines currently in use, the felt is subjected to cleaning and conditioning actions that resemble and attempt to imitate the effective cleaning and conditioning process that is now possible only when the felt has been removed from the wet-pressing section.

The felt-cleaning and -conditioning equipment corresponding to the primary purpose of the invention is characterized by the fact that it includes elements that are formed in such a way that when a felt part comes against such a part in the web-pressing section of a paper machine or a similar web-making machine, it has to stretch to open its slits, after which this felt part strives to return to a relaxed state as it passes by the element, and devices from at least one which a liquid is directed to this part of the felt, at least while it is stretched.

According to a preferred embodiment, the longitudinal axis of each element is located both in a horizontal plane and in a vertical plane such that the angle at which it contacts the element is about 30-90° with respect to the direction of travel of the felt.

It is appropriate that each element be supported so as to rotate about a horizontal or essentially horizontal axis and that its outer surface consist of ridges and valleys in longitudinal section, the outermost parts in the radial direction are coils of strips or spirals in the shape of a double cone, such that with respect to its diameter, the largest part is located or largest parts are located at the middle of or near the center point of the length in the axial direction and the parts whose diameter is smallest or whose diameters are the smallest diameter and a diameter smaller than the largest diameter are located at or near opposite ends of the element.

It is appropriate that the number of elements be or include two sets of elements, each of which is connected to one or more devices by which a liquid or liquids is directed onto the felt and in which there are suitable openings.

According to the preferred embodiment, the axis of rotation of each element is also in a vertical position that is at an angle of 30-90 degrees with respect to the direction in which the felt is moving when it is in contact with the element.

The invention also includes a cleaning and conditioning method for the felt in the wet-pressing section of a machine that produces paper or another web, which includes the following phases, specifically: opening the small slits in the felt by making part of the felt stretch in at least two directions oblique to the direction of travel of the felt, directing at least one dirt-removing liquid to this part, and allowing this part to return by itself to a relaxed state.

It is appropriate that the method also include the following phases, specifically: directing a large quantity of dirt-removing liquid to a part of the felt to saturate it at a first station, directing a second quantity of dirt-removing liquid to this part at a second station, through which this part travels after passing through the first station, and achieving to a low pressure, which makes the liquid or liquids that came to it at the first and second stations leave by itself/themselves to the extent necessary to make the felt return to suitable condition for producing the paper or other web.

The invention will be explained further in connection with the drawings.

Figure 1 shows the felt-cleaning and conditioning equipment according to the invention, in a top view.

Figure 2 depicts the equipment according to Figure 1 in a side view.

Figures 3 and 4 shows a saturation device included in the equipment according to Figures 1 and 2, in top and side views.

Figure 5 is a schematic which shows how the equipment, only part of which can be seen in the diagram, can be divided into to parts that can be separated from each other without difficulty, in order to make them fit into the framework of a wet-pressing section into which the equipment cannot be made to fit in accordance with Figure 1.

Figure 6 is a flow chart which shows a system that applies to feeding clean water and a cleaning agent to two stations, at which these liquids are directed onto the felt.

The felt-cleaning and –conditioning equipment according to Figures 1 and 2 includes a box, the sides 10, 11, ends 12, 13, and bottom 14 of which are stiff and essentially free of holes and the top is essentially open. There are rods 15 that hold the top edges of the sides 10, 11, firmly together, which are slightly convex in cross section, Figure 2. The sides 10, 11 and the bottom 14 are not of equal size, but are split in such a way that parts of the box can be connected to each other in a water-tight manner with bolts 16, 17 by flaps on the parts, so that it is also easy

to separate them from each other, for a reason that will be explained later. There are two joint seats 18, 19 in the bottom 14, each of which has a radial flap 20. Seat 18 is usually closed in a watertight manner by a side plate 21, because the equipment is usually used in accordance with Figures 1 and 2. Seat 19 is intended to be attached to the box, directly or indirectly [to] a low-pressure source, not shown. There is also a cleaning door 21' at the bottom 14 of the box.

The top edges 22, 23 of the ends 12, 13 are curved, to prevent damage to the felt.

Two stations are located in the box, by which dirt-removing liquids is/are directed onto the felt traveling in the direction of arrow 31 of Figure 2. These stations are located above the bottom 14 of the box and extend to the left and right sides of an intermediate wall 32. The first station, on the left side of the intermediate wall, has nozzles 33, 34, a saturator 35, and two elements 36, 37, of which element 36 is located between nozzle 33 and the saturator 35. Elements 36, 37 rotate separately about an essentially horizontal axis. In the case shown, they are in the same direction and there are ribs or coils of spirals 38, 39 in them that follow double cones in opposite directions. These ribs or coils 38, 39 are such that the length of the coil of the element at the center point or center points has the greatest diameter and such that the coils at the end of or near the ends of the element has the smallest diameters. In each nozzle 33, 34 there are holes such that the liquid spray is directed upward and toward the adjacent device 36 or 37. In the saturator 35, shown in Figures 3 and 4, there are holes 40 such that sprays are directed upward from them and toward devices 36, 37, and also to a pair of slits 41, which are two parallel slits of equal size in the case shown.

It can be seen in Figure 4, which is a longitudinal section of the saturator, that the upper part 42 of the surface 35 of the saturator is convex upward over most of the length. This convexity is intended to follow the convexity or correspondingly (in the direction across the box and then in the transverse direction perpendicular to that indicated by arrow 31) which is located, for example, on a line in a plane containing the axis of rotation of the element that connects the ridges of the element or the outermost rib or coil 38 in the radial direction. The uppermost part or some upper part is convex with respect to the surface of each nozzle 33, 34 in the same way as part 42 of the surface of the saturator 35. The convexity of the parts of the nozzles 33 and 34 and the saturator 35 mentioned is intended to ensure that the liquid sprayed upward from the holes of the 40 nozzles 33, 34 and the saturator 35 and toward elements 36, 37, is sprayed against the near surface of the felt as near as possible to the point where this surface of the felt contacts the ridges of the ribs or coils 38, 39. The purpose of the slits 41 is that a relatively large quantity of liquid is applied per unit of time, compared to that pumped through the holes 40.

The second station, located on the right side of the intermediate wall 32, contains nozzles 50, 51, 52, 53, 54, and 55, which are in three pairs, each connected to its own element 56, 57, or 58. Elements 56, 58 have ribs or coils 59, 60 so that elements 56 and 58 are correspond to

element 36. Element 57, in turn, has a rib or coil 61 such that elements 37 and 57 are completely identical in all respects. Likewise, nozzles 50-55 are others completely according to nozzles 33, 34, except at the bottom of their cross section, for the cross section of each point of each nozzle 33, 34 is larger than the corresponding point of nozzles 50-55, so that the first station can also be called a saturating station.

Each nozzle 33,34 and 50-55 includes a part which makes it easy to connect to the supply of dirt-removing liquid or the feed line 62 coming from the feed site, Figure 6. Such parts may be of the same kind as the round part 63 of the saturator 35 shown in Figure 4, which makes it easy to connect the saturator to the feed line 62.

There are control valves in the feed line 62 which preferably control the operating time and by which the amount of cleaning agent is controlled (if a cleaning agent is used to clean the felt) that is directed onto the felt at the saturator station. Operating-time control is not indispensable, but it is important, because the cleaning agents used to clean felts are expensive.

As has been mentioned already, the equipment described above is intended to be attached to a feed line (not shown), which is attached in turn directly or indirectly to devices (not shown) by which the box becomes a suction box. A branch 19 and a flap 20 are used to connect to the equipment holding the liquid. The suction box obtained in this way is installed in such a way that it moves across the felt 30 in such a way that it contacts the felt essentially from the bottom of the horizontal return half. The drive machinery has not been shown, because it is not an object of the invention and because the drive machinery for the felt cleaners and conditioners are known in the paper industry.

The purpose is that the part of the felt 30 that moves over elements 36, 37, 56, 57, and 58 along with the cycle stretches slightly, but enough, however, that the small slits in the felt open. When the small slits open in this way, it is easier for the dirt-removing liquid (cleaning agent or water) to penetrate into the small slits, so it can be said that cleaning of the felt is due to or results from this penetration. Opening of the small slits in the felt makes it easier for the dirt-removing liquid (water) sprayed at the second station to penetrate into the slits, so it can be said that rinsing of the felt is due to or results from this penetration. It can thus be concluded that the alternating stretching of the felt and its return to a relaxed state as it goes over the elements and the side pushes (first in one direction and then in the opposite direction) applied onto the felt surface by the ribs or coils of the element at the same time make the cleaning resemble the washing effect achieved by hand washing or rotating in the water of a washing machine.

The preferred angle between the horizontal longitudinal or axis of rotation of elements 36, 37, 56, 57, 58 and the direction of motion of the moving felt 30 is 90°, as also shown in the drawing. In has been observed, however, that at least some of the advantages of the system shown in the drawings can be obtained even if some of the elements are installed in such a way

that the angle between them and the direction of motion of the felt is less than or greater than 90° while the longitudinal or rotation axis of the element is horizontal. It would also be possible to use only elements rotating in the same direction, for example according to element 36. The more the angle between the element and the direction of motion of the felt differs from perpendicular, the more important it is to adjust the pitch of the rib or coil, so that the ridges and valleys of the element, which appear obliquely to the direction of motion of the felt, are as desired.

It is also possible to use elements that are uniform with each other, in which there are adjacent ring-like ridges, the center plane of the envelope of which is perpendicular or essentially perpendicular to the axis of rotation of the element. The elements are then to be placed in such a way that the angle between them and the direction of motion of the felt is less than 90°, but not less than 30°.

In addition, it would be possible to make the equipment contain two series of elements. The width of the box would then be twice as much as shown in Figure 1. There would have to be another five elements in the box (with their associated nozzles, etc.), which would be of the same kind as elements 36, 37, 56, 57, 58, and either match or do not match them or would be in accordance with guidelines included in the previous paragraph in their structure and positioning.

When the various parts of the framework of the equipment are separated from each other and attached to flaps 16, 17, plates or walls 80, 81, Figure 5, and side plate 21 is detached, then it is possible to connect branches 83, 84 of line 82 to seats 18, 19 in a liquid-tight manner. In this way, it is possible to place a device according to the invention in a machine, in the wet-pressing section of which a felt roller 85 is located as some point or some point in such a way that installation would otherwise be impossible.

In order to prevent clogging, it may be necessary to provide a hole or holes in the intermediate wall 32 or perhaps make it removable and installable in the manner of the hatch of the lock. The intermediate wall 32 is made to decrease in size due to the effect of suction at the first or saturator station, to as small as possible, which presumably has the consequence that liquids leaving the felt, due to the effect of either gravity alone or both gravity and suction, accumulates to form a basin or a damming effect (to the left side of intermediate wall 32 according to Figure 2). In practice, the result is that elements 36, 37 are able to take liquid or liquids along from this basin and sling it/them onto the felt.

The recommended main dimensions of the equipment according to Figures 1 and 2 are:

Length (measured in direction of motion of the felt): about 1.5 m.

Width (at the point of the first and second stations): about 30 cm.

When the equipment moves across continuously, each part of the felt in the wet-pressing section is cleaned and conditioned several times before the equipment stops contacting it as it moves across. This motion must be somewhat slow, because the suction effect is such (for

example on the order of fifteen millimeters of mercury) that it attempts to pull part of the felt (where the suction is being applied at the time) in a direction perpendicular to the direction of motion of the felt if the speed is too great.

We have known for a long time how to use felt-cleaning and –conditioning equipment in such a way that the equipment moves back and forth across the machine. For this reason, the operating machinery to achieve the back-and-forth motion has not been included in the drawing to which the above description relates. Operating machinery according to British patents 263,593, 516,712, and 553,771 can be used, possibly modified in such a way that the changes have no inventive significance. Alternatively, the known felt-conditioning operating equipment manufactured by Vickery Limited of London, which operates with liquid can be used, in which case the transverse motion of the conditioning box is achieved by dual-action cylinders that act against the pressure of the liquid in such a way that each conditioning box moves across the felt between two end positions. The operation runs separately from the paper machine, so it is possible to make the boxes move in one direction across the felt at a certain speed, which is determined on the basis of the length of the felt and the speed of the machine, and much faster than this set speed in the other (opposite) direction.

Said known Vickery felt conditioner, which uses a liquid, is connected to a support on which there are a motorized pressure pump, a container and filters, to which control and direction-changing machinery can be added, which can be placed wherever desired, for example in connection with a control desk. If liquid can be obtained from the machine at a pressure of 35 kp/cm^2, for example, then it can be used instead of a power device that uses a liquid.

Said known Vickery felt conditioner, which uses a liquid and is intended for wide paper machines, receives its suction and water and/or cleaning-agent supplies from internal tubes that are connected permanently to feeders that are outside the width of the paper machine, so no separate hoses are needed at the machine location.

In order to facilitate production of such a permanent box, so that it is easy to divide or change to correspond to a purpose, as shown in Figure 5, it may be also necessary to provide, in addition to flaps 16, 17 located at the point shown in Figures 1 and 2, two flaps near the division point located on the intermediate wall 32, which is located on the right of the intermediate wall according to Figure 2. In this case, the intermediate rod 15 drawn at this point would be omitted.

It is well known that it is possible to install conditioning boxes horizontally or vertically. The statements in the patent claims are thus not intended in any way to limit installation of the equipment in a paper machine or other web-making machine to horizontal. It is considered, however, that horizontal installation is better, because each separate element is supported by only one of its bearings if the box according to Figure 1 is installed in the vertical position.

Finally, concerning elements 36, 37, 56, 57, and 58, the rib or coil in the shape of a double cone, with which each element is provided, can be formed advantageously from two cone-shaped spiral ribs or coils that meet at the center point of the element and rotate in opposite directions. In this case, each element would still curve in a convex manner in the direction across the felt, like elements 36, 37, 56, 57, 58, but instead of the element squeezing or pulling the felt in only one direction (as happens in the structure according to Figure 1), the felt is squeezed or pulled in two opposite directions. Such ribs or coils rotating in opposite directions can be advantageous when preventing liquid or liquids that has/have been raised from running toward the outer edges of the felt on the box is involved.

Claims

1. Transversely moving felt-cleaning and conditioning equipment, characterized by the fact that it includes separately rotating elements that are shaped such that the part of the felt in a paper machine or similar web-making machine that comes against this part is stretched to open its slits, after which this part of the felt tries to return to a relaxed state as it passes the element, and elements of which at least one directs a dirt-removing liquid to his part of the felt, at least while it is stretched.

2. Equipment according to Claim 1, characterized by the fact that each element is supported so as to rotate about a horizontal or essentially horizontal axis and its outer surface consists of ridges and valleys in longitudinal section, which ridges are the outermost parts in the radial direction are helical ribs or coils in the shape of a double cone around the axis, such that the part with the largest diameter is located or the largest parts are located at the center point of the length in the direction of the axis of the element or near it and that the parts whose diameter is smallest or whose diameters are the smallest diameter and a diameter smaller than the largest diameter, are located at or near the opposite end points of the element.

3. Equipment according to patent Claim 1, characterized by the fact that each element is supported so as to rotate about a horizontal or essentially horizontal axis and its outer surface consists of ribs and valleys in longitudinal section, which ridges are the outermost parts in the radial direction of ring-like ridges that are separate from each other in the direction of the axis of the element and the central plane of the envelope of each of which is perpendicular or essentially perpendicular to the direction of the axis.

4. Equipment according to Claim 2, characterized by the fact that the axis of rotation of each element is also in a vertical plane that is at an angle of 30-90 degrees to the direction in which the felt is moving as it is in contact with the element.

5. Equipment according to any of the preceding claims, characterized by the fact that the number of elements is or includes two set of elements, each of which is connected to one or more

of the devices by which liquid or liquids is/are directed onto the felt and in which there are suitable openings.

6. Equipment according to Claim 5, characterized by the fact that the first set of elements is connected to a first set of devices that can be used to direct clean water and/or a cleaning agent onto the felt.

7. Equipment according to Claim 6, characterized by the fact that each of the devices in the first set of devices is a saturation device that is located between two adjacent elements of the first set of elements and in which there are holes such that a larger amount of water and/or cleaning agent can be directed from them onto the felt per unit of time than in the same unit of time through any other device in the first set of devices.

8. Equipment according to Claim 6 or 7, characterized by the fact that the first set of elements is located in such a way with respect to the second set of elements that the felt that comes into contact with their first and second sets of elements comes into contact with elements of the first set of elements first and then elements of the second set of elements.

9. Equipment according to Claim 6, 7, or 8, characterized by the fact that it includes control machinery (especially an adjustable time control) that can be used to adjust both the quantity of cleaning agent going through the first set of devices onto the felt and the arrival time of the cleaning agent.

10. Equipment according to Claim 5, characterized by the fact that the second set of elements is connected to a second set of devices that can be used to direct clean water onto the felt.

11. Equipment according to any of Claims 6-9, characterized by the fact that at least the uppermost part and/or some top part of the surface of each device of the first set of devices is curved over most of its length in the direction of the axle, in the longitudinal section of the device, in such a way, transversely to the direction in which the felt is traveling as it makes contact, that this surface is exactly or approximately according to the transverse curvature, that each different part of the felt has received or receives because of an element, and that the uppermost part and/or an upper part is/are the part or parts in which there are holes to all liquid or liquids to pass.

12. Equipment according to Claim 10, characterized by the fact that the uppermost part and/or some top part of the surface of each device of the first set of devices is curved over most of its length in the direction of the axle, in the longitudinal section of the device, in such a way, transversely to the direction in which the felt is traveling as it makes contact, that this surface is exactly or approximately according to the transverse curvature, that each different part of the felt has received or receives because of an element, and that the uppermost part and/or an upper part is/are the part or parts in which there are holes to all liquid or liquids to pass.

13. Equipment according to Claim 2 or 4 or a patent claim connected with either of them, characterized by the fact that the direction of a rib or coil around the axis of an element of the set of elements is opposite with respect to the direction of at least one rib or coil of an adjacent element.

14. Equipment according to one of the above claims, characterized by the fact that each element is make of an artificial resin material, especially nylon.

15. Equipment according to one of the above claims, characterized by the fact that it includes a connection that makes it easy to connect at least some zone of the device to other devices when suction is applied to the felt, in order that liquid or liquids can be pulled from it.

16. Equipment according to Claim 5 or 15, which is connected to it, characterized by the fact that is can be divided into two parts that are easy to separate from each other and one of which contains the first and the other the second set of elements and that each part has its connection part, which, together with a guide device, make it easy to connect the zone of the part to other devices.

17. Equipment according to Claim 2, characterized by the fact that the rib or coil consists of two cone-shaped helical ribs or coils that meet at the center point of the element and rotate in opposite directions.

18. A machine producing paper or another web, characterized by the fact that it includes transversely moving felt-cleaning and conditioning equipment according one of the above claims.

19. A machine according to Claim 17, characterized by the fact that the width of the machine, and likewise of the paper or other web made on it, are such that two or more adjacent sets of equipment are needed for the wet-felt section across the width.

20. A machine according to Claim 18, characterized by the fact that equipment is connected to the machinery, by means of which it is made to move each time across the machine in one of two directions across the width of the machine, which directions of motion are perpendicular or essentially perpendicular with respect to the direction of motion of the paper or other web.

21. A machine according to Claim 19, characterized by the fact that there is more than one set of machinery and that more than one set of equipment is attached to each set of machinery.

22. A machine according to Claim 19 or 20, characterized by the fact that each set of machinery uses a liquid.

23. A machine according to Claim 19 or 20, characterized by the fact that each set of machinery uses air.

24. A felt-cleaning and –conditioning method in the wet-pressing section of a machine that produces paper or another porous web, characterized by the fact that it includes the following phases: specifically opening the small slits of the felt by making part of the felt stretch in at least two directions oblique to the direction of travel of the felt, directing at least one dirt-removing liquid onto this part, and letting this part return by itself to a relaxed state.

25. A method according to Claim 23, characterized by the fact it also includes the following phases: specifically directing a large quantity of dirt-removing liquid onto a part of the felt to saturate it, at a first station, directing a second dirt-removing liquid onto this part at a second station, through which this part passes after going through the first station, and directing a low pressure to this part, in order that as much of the liquid that has come or the liquids that have come into this part be made to leave as is necessary to return the felt to a condition suitable for making the paper or other web.

[4 pages of claims in Swedish]

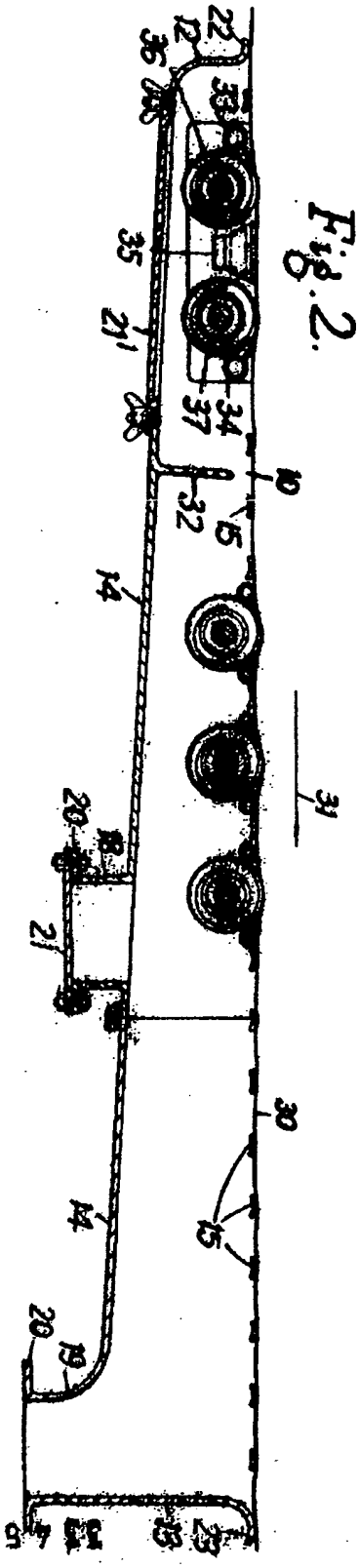


Fig. 2.

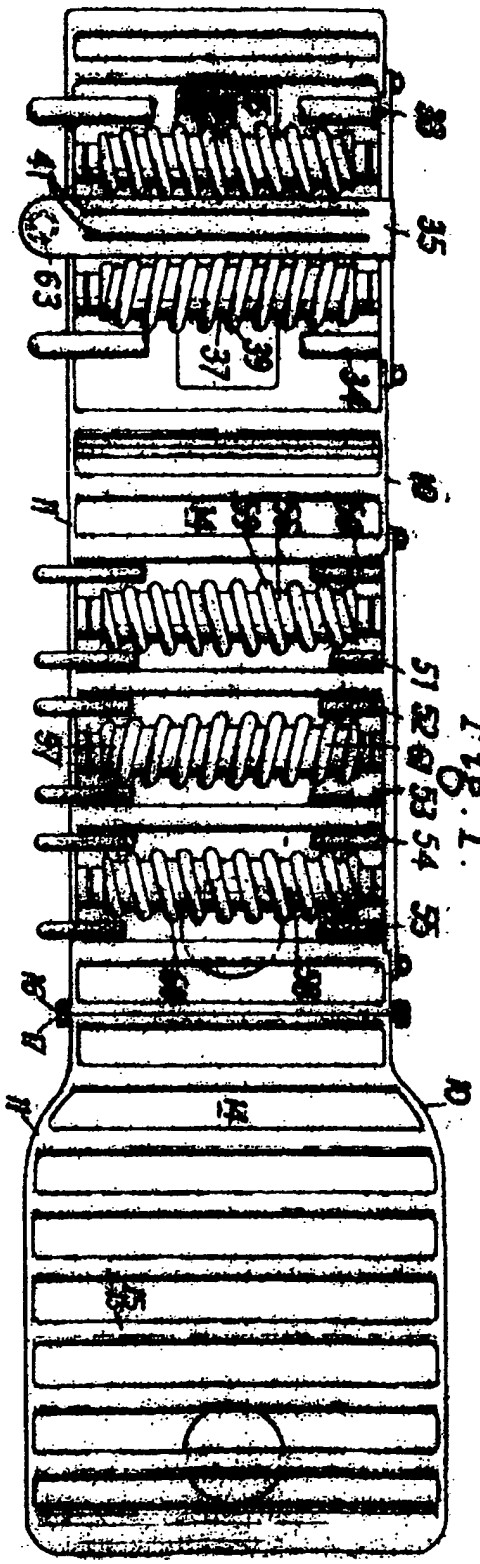


Fig. 1.

Fig.3.

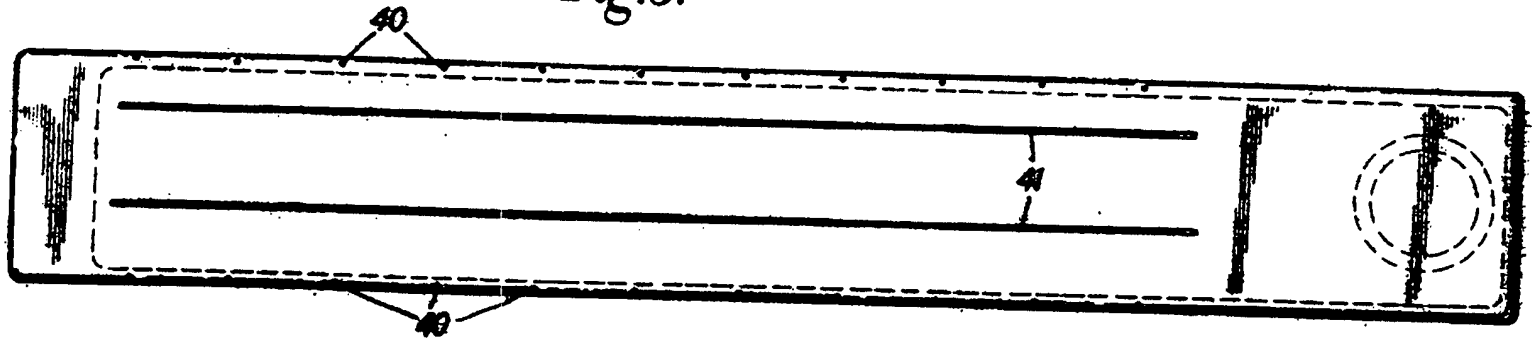
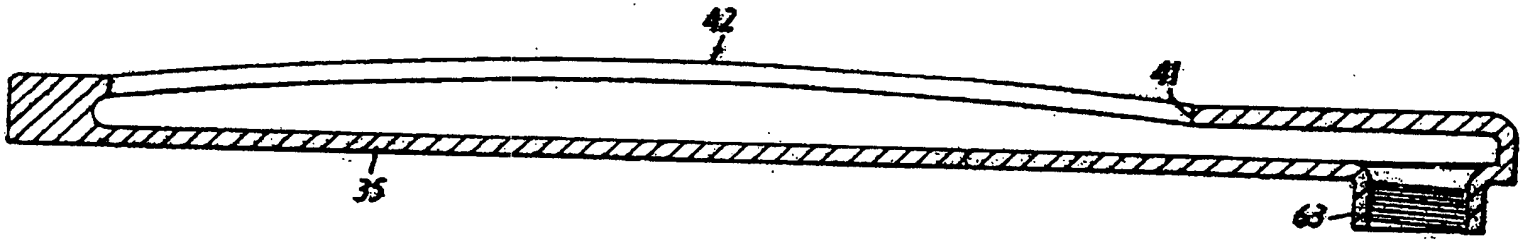


Fig.4.



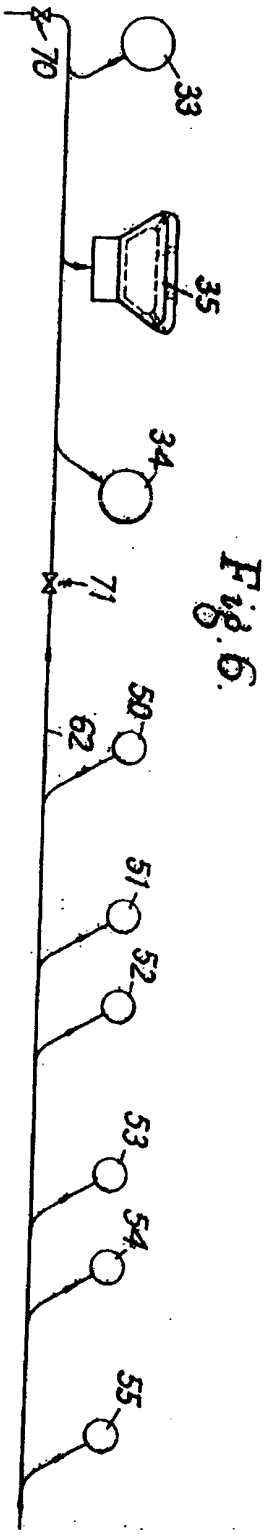
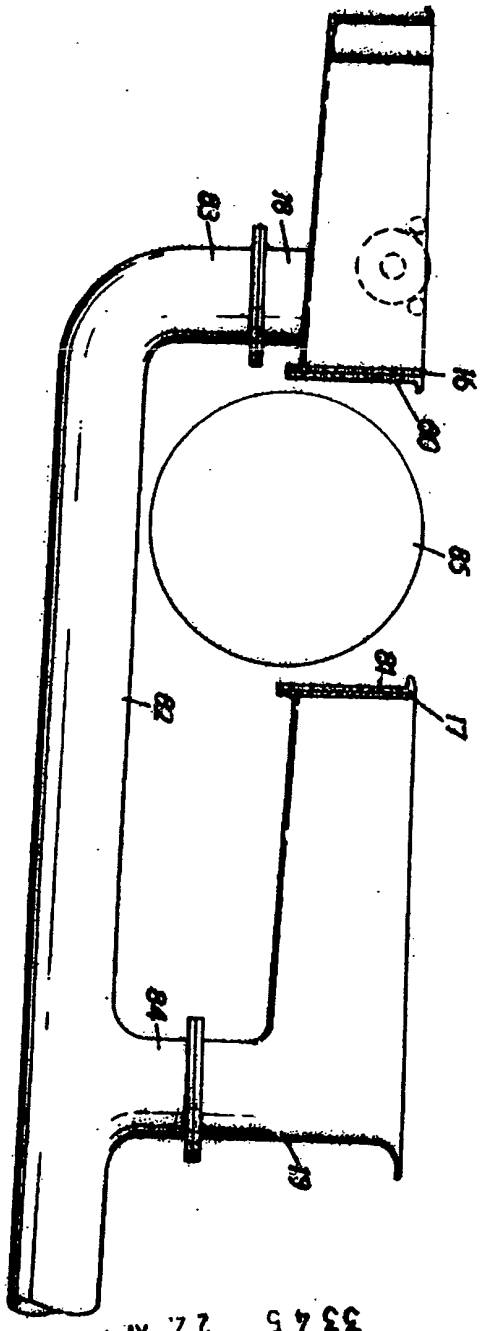


Fig. 6.

Fig. 5.



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